Note on a Possible Source of Error in Measures of Star Places due to Defective Centring of the Object Glass. By H. H. Turner, D.Sc., F.R.S., Savilian Professor.

1. The object of this note is to call attention to the possible existence of a kind of error which has not, so far as I know, been hitherto noticed. It was suggested by the occurrence of a considerable systematic difference, varying with the magnitude of the star, between star-places derived from photographs taken with similar instruments at Algiers and at Paris, for the parallax of *Eros.* See pp. 38–40 of the 11th Circular. I have at present no means of knowing whether the following is the true cause of these differences, but it seems to me to be at least a possible cause, and one which may produce small systematic errors in general.

2. If the two lenses of an object glass are not correctly centred, *i.e.* if their optical axes do not truly coincide, the image of a star will be a small spectrum. For simplicity suppose there are two colours, red and blue, side by side. For a faint star the red rays will not affect the plate, and the image will be formed by blue rays only. But for bright stars both blue and red will affect the plate, and the centre of the image will therefore be displaced towards the red end as compared with the image for faint stars. There will thus be an error of place, depending on stellar magnitude, which may be in any direction, according to the nature of the defect. The error is similar in some respects to that called " guiding error," but is constant in its effects so long as the object glass is not disturbed.

3. The error may exist theoretically with either visual or photographic telescopes ; but there is this reason for its being more likely to be serious in the latter case : viz. that the star images are not under regular inspection, as with a visual telescope, so that an unsymmetrical distribution of colour in the image might pass unnoticed.

4. The error can be both detected and eliminated by reversing the objective with reference to the stars and comparing plates taken in the two positions. In the case of telescopes mounted in the German fashion, which are reversed on opposite sides of the pier, comparison of measures taken east and west of the pier will show the error in each coordinate. It is to be noticed that in this case the error comes (doubled) into parallax measures, but is eliminated from mean results. For telescopes mounted English fashion, such as those at Paris and at Algiers, the ordinary plates do not furnish the means of detecting or eliminating the error (except by comparison with plates free from it).

5. The telescope at Oxford is mounted German fashion. Four years ago Mr. F. A. Bellamy, as a general precaution and without reference to this particular suggestion, took the same field of stars twice on the same plate, reversing the telescope between the exposures, and also turning the plate 180° in its holder, so that

the corresponding images are juxtaposed all over the plate. We thus had a ready means of testing the existence of this error in the Oxford glass at once. The plate was partially measured by Mr. B. Gray on November 7 and 8, taking, in the first instance the three bands across the plate between the values $y=0·0$ to $5·0$, $y = 11·0$ to $15·0$, $y=21·0$ to $26·0$ (*i.e.* two outside strips and one central), and afterwards the omitted portions, $y = 5·0$ to $11·0$ and $y = 15·0$ to $21·0$. A comparison of the two sets gives a general check on the results, but has no particular significance.

The differences (corrected by linear corrections of the simple form $\Delta x = by + c$, $\Delta y = -bx + f$) were grouped according to the diameters of the photographic images and gave the following mean results :—

Plate 1623.   R.A. 21^h 18^m $+30^s$.

Mean Diam. of Image.	First Set.			Second Set.			Mean.		
	No. of Stars.	Δx.	Δy.	No. of Stars.	Δx.	Δy.	Δx.	Δy.	Total Stars.
$30''$	93	$-0·06''$	$-0·09''$	72	$+0·03''$	$0·00''$	$0·00''$	$-0·03''$	165
45	57	$+ ·21$	$- ·12$	61	$+ ·21$	$+·12$	$+·21$	$·00$	118
60	38	$+ ·15$	$- ·27$	34	$+ ·12$	$+·18$	$+·12$	$- ·06$	72
78	17	$+ ·21$	$- ·12$	16	$+ ·18$	$+·03$	$+·21$	$- ·03$	33
99	11	$- ·12$	$+ ·06$	9	$·00$	$+·09$	$-·06$	$+ 0·9$	20
140	5	$- ·54$	$+ ·18$	5	$- ·66$	$-·18$	$-·57$	$·00$	10

6. There seems to be possibly a sensible effect of the kind under consideration in the x coordinate ; but it must be remembered that the results for a single plate may be affected by " driving-error," and a systematic effect due to the objective can only be established by measuring a number of plates.

7. Finally, it is to be remarked that any error of this kind is likely to be altered when the lenses of the objective are separated for cleaning. Now I have published two papers (see *Monthly Notices*, lxiii. p. 56 and lxiv. p. 3) on the proper motions of bright stars relatively to faint stars, deduced from a comparison of measures made on plates taken at the University Observatory about 1893 and about 1898. At the time of writing them I did not know of any source of instrumental error likely to affect the results ; but, since the lenses of the objective were separated for cleaning in 1894 July, it seems now possible that the results given in the two papers above quoted are affected to an unknown extent by an error of the kind now indicated, and the results therein given must be accepted with this reservation accordingly, until further examination of the point can be made.

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